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ANALYSIS USING OPEN SYSTEM MODEL ON LOGISTIC DEPARTMENT IN RUMAH SAKIT IBU DAN ANAK KENARI GRAHA MEDIKA

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Abstract— The Logistics department in Rumah Sakit Ibu dan Anak Kenari Graha Medika (RSIA KGM) where this research is the department that act as the key of cost structure of firm that support the whole operation. The department focused on targets that stated as goals to be achieved that consist of stock, store supplies, administration, distribution to units, monitor and control, and response. Currently logistics department couldn't fulfill the target of their operation. The root cause of the research is the lack of standardized operational guidelines. The root cause is causing confusion in the department that resulting lost sales, defect supplies, and expired supplies. The method that used to reach the goals is open system model. The model acts as the guide to make a better system. The model which draws the input-throughput-output model with feedback looped to adapt throughput to the environment. The environment consist of all elements outside the system that have the potential to affect that all part of the system. The result will generate feedback that will be used for future transformation. The solution in this research will show the procedure of all logistics activities. Logistics activities in RSIA KGM consist of 6 main activities, they are order supplies, accept and check supplies, store supplies, grant request of supplies, return supplies, and documentation. The usage of stratified random sampling, colored tag, control card, Reorder point, and risk mitigation plan will become the way for logistics department to reach their targets. Even though the old system is simpler, but it is subjective and have disorganized activities. The proposed system have structured activities and standardized procedure, but in the other side the system is quite complex and it will need well trained employee.

Keywords: Open system model, standard operational procedure, Reorder point, Logistic, Rumah Sakit Ibu dan Anak

1. Introduction

The health of firms could be checked by using financial ratio, liquidity ratio, profitability index and other methods. The main point of these method is knowing the real condition of firms. A well looking firms doesn't always have a high liquidity ratio, they may have the funds sourced from debt rather than cash in hand. There are two ways to generate cash, it is either increase the revenue or optimizing the cost. Even though increase the revenue looks easier to do, but when there is no other way to do, they must do something to gain other competitive advantage. In the other side, when firms want to gain competitive advantage, they will need some cash. At this point, it is the point where optimizing cost is the only way to make the firms healthier.

When the firms are restricted due to incapable of generate resources, they will have a weak power as buyer. Optimize the key activities is the most likely act to optimize the cost of a firm. Either service firms or manufacture firms must be have logistic as the pivot of their operational system. Logistic is the art and science of obtaining, producing, and distributing material and product in the proper place and in proper quantities. Logistic provides the equipment or material to the firms as the prerequisite of their activities. When the logistics system having a failure, that's become the time when the firms are disabled due to incapable of serve customer because they don't have the resource to do so. (Jacob, chase, and aquilano:2009)

2. Company Profile

Rumah Sakit Ibu dan Anak Kenari Graha Medika or abbreviated with RSIA KGM is held in *PT. Bulan Sabit Sejahtera* as a single holder. The hospital is classified as hospital type C. Type C is a general hospital that having fewer than 100 beds. The hospital built since 2010 that located in Perum. Griya Kenari Mas Blok B2 Cileungsi Kidul. RSIA KGM positioning itself as mother and child hospital in area around Cileungsi.

RSIA KGM have logistic department that act as a controller in the flow of supplies. RSIA KGM logistic department open in weekdays from 8 AM to 4 PM and Saturday from 8 AM to 1 PM. Any orders outside the open hour need to be hold except for emergency needs. In emergency, the procurement from warehouse must be done by people from aphotic. This system makes the need of supply of RSIA KGM in weekend must be predicted beforehand in Friday. Logistic department activities categorized by 5 types, order supplies, check and accept income supplies, store supplies, grant request of supplies, and documentation. Order supplies activity is order supplies to the distributor. Check and accept income supplies activity is accept and check the arrived supplies. Store supplies activity is put the supplies into shelves in the warehouse. Grant request of supplies activity is give the requested supplies. Documentation activity is report and write any activities that happen in the warehouse.

3. Business Issue

Logistics department is holding the key of cost structure of a firm. Their activities reflect the firm efficiency and effectiveness on operation. Logistics department is already done logistics management in traditional way which is by simple management for warehousing, inventory management, and others. Specific and systematic acts to analysis logistic activities haven't done by the logistics department. For an example currently the logistics department still doesn't have KPI, but the logistics department have targets of operation to reach perfection. The targets of Logistics are reflected on Table 1.

Table 1. Logistics deparment targets

No.	Criteria	Targets	Success	Failure	Notes
1	Stock (Supplies)	Effective (Supplies matched with demand, no unmet demand)		X	Unmet demand still exist
		Efficient (Supplies are liquid, no expired supplies)		X	Expired supplies still exist
2	Store Supplies	Safe and secure (No lost supplies and countable)		X	Lost supplies are exist and couldn't be counted
		Not Change/Changed (No contamination)	X		
3	Administration	Neat administration (Reliable data)		X	Unmatched data between supply card and program
4	Distribution to units	Controllable (Supplies Quantity/Time/Item matched with requests)		X	Unmet demand still exist
5	Monitor and control	Supplies traceable and monitored (No expired and lost supplies)		X	Expired and lost supplies still exist
6	Response	Unpredictable event solved (No unmet demand)		X	Unmet demand still exist

4. Conceptual Framework

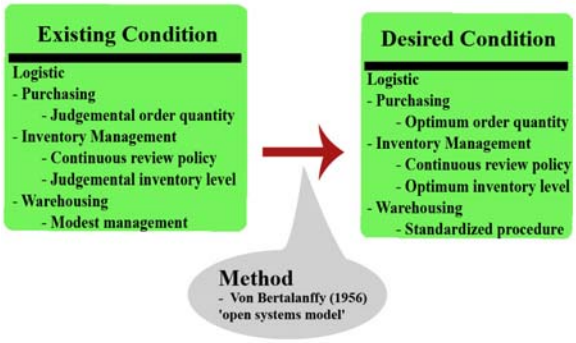

Figure 1. Conceptual Framework

Figure 1 shows the shows the conceptual framework for this research. The existing condition of RSIA KGM logistic department is having three key problems, purchasing, inventory management, and warehousing. The logistic department doesn't has any transportation activity because it only operate in static place. The logistic department doesn't do any movement like delivery because the requestor come by themselves. The logistic department operational activities overall is using a judgmental approach where the approach doesn't always guarantee a good condition. The desired condition for RSIA logistic department is having optimum and standardized activities. In order to reach the optimum condition, it will need a method called open systems model that popularized by Von Bertalanffy in 1956.

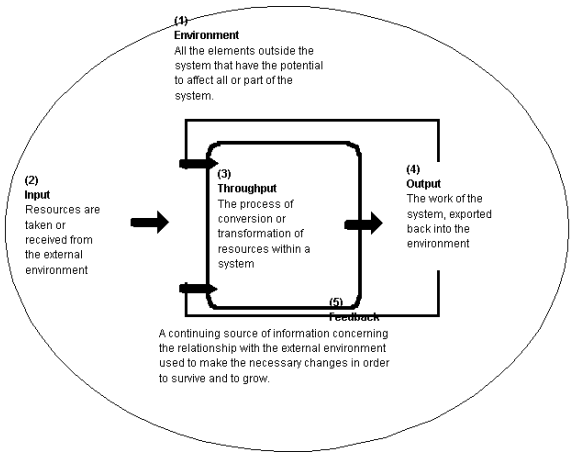

Figure 2. Open system model
(http://business.nmsu.edu/~dboje/655/655_syllabus.htm,2013)

Figure 2 shows the model of input-throughput-output with feedback to adapt the throughput to the environment. The environment consist of all elements outside the system that have the potential to affect that have the potential to affect all of part of the system. The input is the resources that taken or received from the external environment like material and energy. The throughput is the process of conversion or transformation of resources within a system. The output is the result of the process that returned back to the environment. The feedback is the source of information concerning the relationship with the external environment that used to make the necessary changes in order to survive and grow.

5. Root Cause

The analysis of the problems of operational activities in RSIA KGM logistic department is using 5-Why. Table 2 shows the 5-Why analysis of problems in RSIA KGM logistic department.

Table 2 5. Why Method

WHY NO.	WHY	REASON
1	Why the logistic department need for to be changed?	Because the logistic department generate loss
2	Why the logistic department having a bad condition?	Because the logistic department is having a defect products, lost sales, and expired products.
3.1	Why the logistic department have defect products?	Because either the bad quality distributor or bad checking method.
4.1	Why the logistic department have a bad quality distributor?	Because the logistic department doesn't check the distributor quality neatly.
5.1	Why the logistic department doesn't check the distributor quality neatly?	Because there is no such written procedure.
3.2	Why the logistic have lost sales?	Because the logistic department have wrong order prediction.
4.2	Why the logistic department have wrong order prediction?	Because the logistic department have a bad documentation system and there is no written procedure for the order prediction.
5.2	Why the logistic department have a bad documentation system?	Because the logistic department doesn't has written procedure for the documentation.
3.3	Why the logistic department have expired products?	Because the logistic department is having a hard time on control the supplies.
4.3	Why the logistic department have hard time on control the supplies?	Because the logistic department is having too many supplies and unsupported facility.
5.3	Why the logistic department is having too many supplies?	Because the logistic department have wrong order prediction.
6.3	Why the logistic department have wrong order prediction?	Because the logistic department have a bad documentation system and there is no written procedure for the order prediction.
7.3	Why the logistic department have a bad documentation system?	Because the logistic department doesn't has written procedure for the documentation.

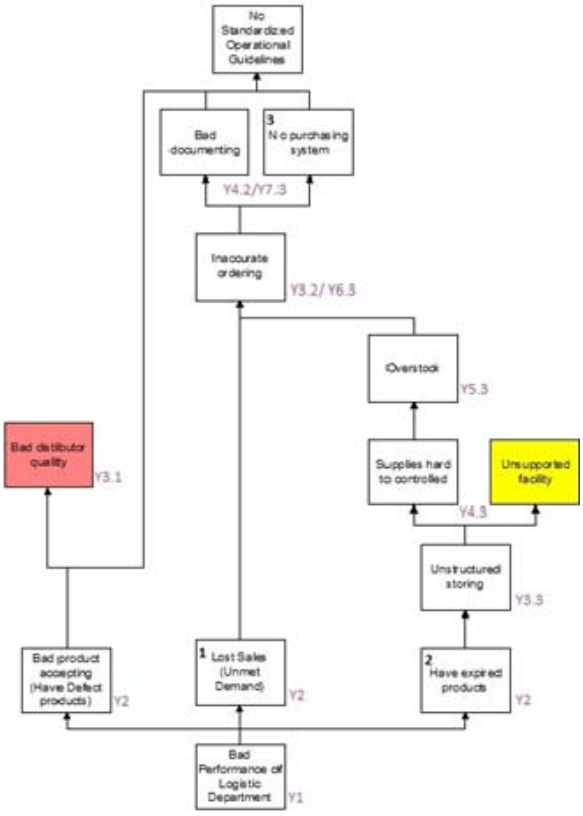

Figure 3. Root Cause Analysis

In the Figure 3, the red box means the root cause is couldn't be handled by logistic department because it is on another party responsibility. The distributor quality is on each distributor responsibility. The way to solve that problem is just simply change the distributor. The yellow box in Figure 3 means the root cause is not logistic department control, but it could be managed because it's still on RSIA KGM responsibility. Currently logistic department of RSIA KGM is having a minimum facility due to restricted budget and space. The things that logistic department do is optimizing their operational activity to gain optimum cost to support RSIA KGM growth. The root cause of logistic department bad performance is no Standard Operational Procedure (SOP). The root cause is creating 3 main problems that causing the bad performance of logistic department, they are lost sales (Unmet Demand), have expired products, and no purchasing system.

6. Solution

As mentioned in the previous chapter that explains about the condition of RSIA KGM logistic activities, the problems that founded is RSIA KGM logistic department need a change in their system. The root cause of the performance of RSIA KGM logistic department is need of standardization of operational procedure. In response to the root cause that already identified, the open system method will be implemented to solve the problems. As mentioned in previous chapter, the framework of this research is separated into 5 steps, environment, input, throughput, output, and feedback. The environment of the system in this research would be the market demand and distributor that could affect the system which is the logistic activities by the logistic department. The input of the system in this research would be the demand of product and distributor capabilities that will formulated in the throughput process to make a better logistic system in RSIA KGM. The transformational process in throughput activities is the guidelines of the activities in order to utilize the input better than before.

The objectives of the research would be generate the solution that solve the problems. The objective is to gain optimum condition for logistic department that could optimize the operational activities of logistic department, minimize the probability of unwanted incident occurs, and minimize the impact of the unwanted incident if they happened. In response to reach the optimum possibility for logistic operational activities, a structured Standard Operational Procedure (SOP) solution is arise. The SOP is the guideline or instruction of a routine and repetitive activity that written in a document. The usage of SOP believed could enhance the quality control of a product. The SOP provides a list of information for individuals to perform job properly.

Currently logistic department use judgmental purchasing policy for the order supplies activity. They couldn't predict the future, so they prefer to order in response of each demand that comes that exceed the supply stock. The reorder point and the order quantity of current system using judgmental policy. The judgmental policy doesn't guarantee of an optimum cost or optimum operational activities.

The provision of order supplies are:

a) Reorder Point

Reorder point (ROP) is the point where the supervisor of supplies need to place and order. The order time usually varied between distributor and also there are also the possibilities of delayed or late deliveries. The theories explain the formula of ROP like in the equation 1.

$$ROP = d \times L \quad \text{.....(1)}$$

d: Average demand
L: Lead Time

Average demand is the average of demand in some period. Lead time is the gap time between the order supplies with the delivery of supplies. So, ROP is the level of supplies to fulfill request during the lead time. (Chopra and Meindl. 2010)

b) Safety Stock

Supply chain specialist also stated there is a level of minimum supplies with additional of supplies that called safety stock. Safety Stock (SS) is the additional supplies that added in the minimum level of inventory to avoid the probability of sudden request of supply that may lead to lost sales. The theories explain the formula of SS like in the equation 2.

$$SS = z \times \sqrt{L} \times \sigma_D \quad \text{.....(2)}$$

z: Service Level
L: Lead Time
σ_D: Standard Deviation of Demand

Service Level is the probability of being in stock during lead time period. The value of service level could be searched using normal distribution table. σ_D is the standard deviation of demand that given for plan the SS. So, SS is the level of supplies as the precaution of sudden request during the lead time. In addition of safety stock, the formulation of ROP changed like in the equation 3. (Chopra and Meindl. 2010)

$$ROP = (d \times L) + SS \quad \text{.....(3)}$$

c) Order Quantity

The order quantity when the supplies reach the ROP is depend on the fill rate of the logistic department. The fill rate level measures the proportion of demand that is satisfied from the warehouse. The theories explain the formula of fill rate in equation 4.

$$fr = \frac{(Q - ESC)}{Q} \quad \text{.....(4)}$$

Q: Order Quantity
ESC: Expected Shortage per replenishment Cycle

Fill rate equation consist of order quantity and Expected Shortage per replenishment Cycle (ESC). ESC is the average supplies that are not granted from warehouse per replenishment cycle. The theories explain the formula of ESC in equation 5 that could be simplified to equation 6.

$$ESC = \int_{X=ROP}^{\infty} (X - ROP) f(x) dx \quad \text{.....(5)}$$

$$ESC = -ss\left[1 - F_s\left(\frac{SS}{\sigma_L}\right)\right] + \sigma_L f_s\left(\frac{SS}{\sigma_L}\right) \quad \text{.....(6)}$$

When the ESC is found, the desired fill rate could be founded by using a trial and error method on deciding the order quantity where the logistic department wants the activity is idealized to have almost no error. So, 99,9% fill rate is taken from the target of logistic department target and goal. (Chopra and Meindl. 2010)

Table 3. New Diatab Demand

Year	Month	Demand
2012	March	40
	April	90
	May	147
	June	213
	July	185
	August	204
	September	275
	October	198
	November	218
	December	174
2013	January	114
	February	104

For an example in New Diatab demand for a year start from March 2012 until February 2013 is shown in Table 3.

Table 4. New Diatab Analysis

Lead Time (Day)	1	2	3	7
SS	28,11	39,75	48,68	74,36
ROP	33,56	50,65	65,03	112,51
fr	99,90%	99,90%	99,90%	99,90%
Q	40	60	70	110

Table 4 shows the result of calculation of New Diatab demand. If the lead time is 1 day, the safety stock is 28,11. Since the product couldn't be spared into parts, so every calculation will be rounded to one number above or fitted into packaged supply (ex: 20 Stripes per box). The ROP after the addition of SS is become 33,56. So, the reorder point of New Diatab is when the supplies is touch the level of 34 supplies. The order quantities for New Diatab order is 40 supplies. The number is generated by using trial and error using excel until the fill rate number become the desired number which is 99,9%.

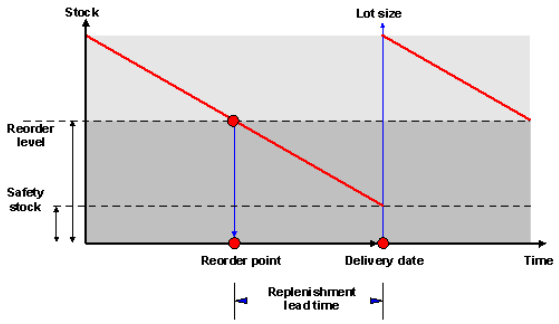

Figure 4: ROP illustration
(http://help.sap.com/saphelp_40b/h elpdata/en/7d/c27102454011d182b40000e829fbfe/content.htm)

The provisions of accept and check income supplies are:

a) Accept and check income supplies must be documented by secretary and supervised by the assistant manager.
b) Income supplies that accepted by logistic staff will be accepted and checked starting at 8 AM until 4 PM in weekdays and 8 AM to 1 PM in Saturday.
c) If in the delivery of supplies there is any rejection by logistic staff because of defects or unqualified supplies with supplies specification, then the supplies need to be exchanged with the same as the order as soon as possible or in the next delivery.
d) If partner or distributor could not or late in the delivery that could disturb the service of RSIA KGM, then assistant manager entitled to take decision according the terms and conditions applied.
e) Check income supplies method are using stratified random sampling to more or less 10% of income supplies in each item.

The provisions of store supplies are:

a) The income supplies that qualified must directly put into shelves, warehouse, or freezer.
b) If the supplies will be used directly, the supplies must monitored by the secretary to be documented before the movement of the supplies.
c) Every income supplies must be noted into supply cards without delay.
d) The supply card must be checked constantly.
e) Every income supplies need to be documented by secretary.

f) Every supplies must be marked with colored tag. The tag indicates the income supplies period (semi-annually).
g) The supply movement is using method called FIFO (First In, First Out). The oldest supplies will be taken before the recent income supplies.
h) The level of supplies must not past the ROP that already stated for each of supplies.
i) The supplies sorted based on the types and alphabetically to make the search of supplies easier.

The provisions of grant request of supplies are:

a) Any request that granted will change the number of supplies data. Supply cards must be filled directly without delay and under supervision of the secretary.
b) Any income request that past the ROP level should still be granted until the supplies depleted completely or recommend to other product with same functionality.
c) Any unfulfilled request will be diverted to another products with the same functionality must under the approval of the requestor.
d) Any unfulfilled request that could not be processed will be put into delayed request and will be fulfilled as soon as possible, and also the number will be considered as lost sales.

The provisions of return supplies are:

a) The one who return supplies in logistics department must be assistant manager as the one who authorized as the people who return supplies that already stated in the organization, authority, and responsibility section.
b) Any supplies that found defect will be returned to respective distributor to be exchanged with new supplies.
c) Any supplies that nearing their expired date will be returned to respective distributor to be exchanged with new supplies.
d) Any supplies that are not liquid will be returned to respective distributor to be exchanged with other supplies.
e) If the distributor couldn't give the same supplies as the supplies that returned, they must give other supplies with the same values.

The provisions of documentation, administration, and report are:

a) Documentation of data must be done neatly, so the logistic activities will be supported and could be done easily.
b) Any data must be kept secretly in order to prevent other parties to use the data for any other reason without the logistic department manager permit.
c) Any data in the administration should be synchronized with other data that have similar data.
d) Any data in the administration must be grouped based on function to make the search of data is easier.
e) Any revision on important data must be noted and split the data into two, the original data and the updated data.
f) Every data that going outside the logistic department must need approval from logistic department manager.
g) The report generated by secretary periodically (monthly) in order to recap the condition of logistic department.
h) The report is used for needs of control and monitor that will be given to logistic department manager.
i) The report that generated demanded to be accurate and on time.

In logistic activities, every activities that could affect RSIA KGM business sustainability and contain strategic risk must equipped with contingency plan as guidance if there are things unwanted. The contingency plan is a plan that cover the detail of handling specific and global disturbance that must owned by every units that doing logistic activities.

Table 5. Contigency Plan

No.	Risk Identification	Risk Sources	Mitigation
1	Information leakage	• Ineffective document security • Low staff integrity • Low staff comprehension level • Staff Negligence	• Socialization of the right procedure • Train staff hard skill and soft skill • Knowledge sharing • Improve monitor and control
2	Service Failure	• Unavailable Supplies	• Socialization of the right procedure • Improve monitor and control
3	Slow Service Response (Delay)	• Slow staff response • Delayed supplies	• Train staff hard skill and soft skill • Add more distributor
4	Existence of Defect and Expired Supplies	• Staff negligence • Low staff integrity	• Socialization of the right procedure • Improve monitor and control
5	Unqualified Distributor	• Low quality distributor • Incomprehension of supplies specification	• Socialization of the supplies specification • Change distributor
6	Delivery Lateness	• Incompetent Distributor • Catastrophe	• Advanced ordering • Add more safety stock
7	Incompetent Distributor	• Wrong distributor assessment	• Assess distributor by doing comparison
8	Invalid Data	• Staff negligence • Wrong data input	• Train staff hard skill and soft skill • Improve monitor and control
9	Untidy Documentation	• Low Staff Integrity	• Improve monitor and control

Monitor and control is under the responsibility of logistic department manager. Monitor and control are the activities to minimize operational risk that could arise in the logistic activities. Monitor and control activities are being done in every activities in the logistic that consist of 6 activities. Logistic department manager use the control card daily in order to avoid negligence on monitor and control.

The summary of the solution is on Table 6 as the comparison and Table 7 as the benefit & consequence matrix.

Table 6. Comparison Table

No.	Criteria	Old System	Proposed System
1	Checking method	Simple random sampling	Stratified random sampling
2	Tagging	Mark approaching expired date supplies	Mark supplies by period
3	Control and monitor activities	Old control card	Old control card with additional control card
4	Plan order method	Judgmental ROP method	Quantified ROP method
5	Risk Mitigation Plan	No risk mitigation plan	Contingency plan for risk mitigation

Table 7. Benefit & consequence matrix

	Old System	Proposed System
Strength & Benefit	Simple system	Structured Activities Standardized Procedure
Weakness & Consequence	Subjective Disorganized Activities	Complex Need trained employees

7. Discussion

The conclusion of this research is RSIA KGM logistics has a single door system where the supplies input and output must past by logistics department. The requestor is nurse and aphotic. The request that accepted by logistics department almost come every day. The high speed of request makes the logistics department demanded to be prepared and have high rate of supply readiness. The service level of logistics department pictures the rate of request fulfilment rate. High service level means logistics department need use of standardized operational activities in order to grant any income request.

The use of standardized operational procedure will make the operational in logistics department will be more structured and standardized. Even though it will be a complex system and need well trained resource, the implementation of the system hopefully will fulfill the goals.

Table 8 shows the factor that indicated the critical success factor of the research. The result of the implementation of new system should be measured and passed all the measurement in the critical success factor.

Table 8. Critical Success Factor

No.	Factor	Definition	Measurement
1	Supplies	Effective	Service Level 99,9%
		Efficient	Supplies flow are liquid. (No expired product)
2	Store supplies	Safe and secure	No lost supplies reported
		Not change/changed (Contamination)	No contaminated supplies reported
		Neat storing management	Structured and neat.
3	Administration	Neat administration	Using standardized procedure
		Reliable data	Data is 100% actual.
4	Distribution to units	Fulfill demand	99,9% demand fulfilled
5	Monitor and control	Supplies monitored and controlled	No returned supplies and usage of standardized procedure
6	Response	Quick response	No unmet demand on unpredictable event

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